**From:** Robert Siegfried [mailto:rsiegfried@valleywater.org]
**Sent:** Wednesday, February 15, 2012 9:44 AM
**To:** Jemaa, Fethi Ben
**Cc:** Blake Sanden; Laosheng Wu
**Subject:** more explanation

Fethi,

- **Leaching Requirement (LR)** is defined to be the amount of water applied to flush out of the root zone excess salts that are present in the soil and which are detrimental to crop production. Different crop types and different varieties of the same crop can differ in tolerance to salinity. The minimum amount of water required to remove salts from the root zone area is estimated using the ratio of the electrical conductivities of irrigation water (applied water) and drainage water (LR= ECiw/ECdw), where ECiw is the electrical conductivity of irrigation water (dS/m) and ECdw is the electrical conductivity of drainage water (dS/m). DWR recommends this equation for calculation of the Leaching Requirement. Any amount of water in excess of the leaching requirement that goes to deep percolation is non-beneficial, and reduces water use efficiency at that scale. It should be noted, however, that due to uncertainties in quantifying leaching requirements, and due to low distribution uniformities of applications, some amount of water in excess of leaching requirement may be reasonable .

**Comment [L1]:** What you have done below is to define the leaching fraction rather than the leaching requirement. The leaching requirement should include a term for crop salinity tolerance threshold.

One possibility is to use Rhoades $L_r$, which equals $\frac{ECi}{5EC^*e-ECi}$, where $EC^*_e$ is the linearly averaged root zone salinity for a given crop, and which is related to Maas' salt tolerance EC thresholds for various crops. Other equations are also possible.

I suggest you give Jim Oster or Dennis Corwin a call:
Jim Oster - oster@ucr.edu

Dennis Corwin - Dennis.Corwin@ars.usda.gov (951) 369-4819

**Comment [L2]:** There is no reason DU for leaching need differ from DU for irrigation.

**Comment [L3]:** To whom?

A little more explanation: Although termed "leaching requirement" in the U.S. Salinity Lab's Handbook 60, "LR= ECiw/ECdw" came to be known as the leaching fraction to distinguish it from formulas that estimate leaching requirements for various crops. Those formulas take into account the crop's salt tolerance; e.g. the leaching requirement for spinach differs from the requirement for alfalfa for a given water quality, and the ECdw under a field of spinach will be lower than the ECdw under alfalfa. The leaching fraction for the spinach will be greater than the leaching fraction for alfalfa, given the same water quality. The point is that the crop's salt tolerance should be taken into account.

It was previously routine to plug the desired crop-related salinity tolerance value into the leaching fraction equation for the denominator, ECdw, to arrive at the leaching requirement. The discipline progressed, and now there are a number of formulas, steady state and transient, containing various assumptions about the distribution of salinity throughout the root zone and giving different results.

All this is likely too fine a point except for the fact your definition as written does not connect the leaching requirement to crops. That connection should be made clear to forestall any tendency to believe there is a single appropriate leaching fraction for a given water quality.

An additional point is that the leaching fraction equation is a long term, steady state equation. It is not completely appropriate for annual calculations.

I suggest you add a sentence to make clear that leaching is also done for control of specific ions. While salinity may be less than the tolerance threshold for a crop in question, a specific ion may exceed the crop's threshold, and generate a requirement for leaching.

I am cc'ing Blake Sanden and Laosheng Wu. They may want to clarify any shortcomings in my explanation.

Regards,

Bob Siegfried
Santa Clara Valley Water District
5750 Almaden Expressway
San Jose CA 95118
408 265 2607